VTI TECHNOLOGIES

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CMA3000 DEMO KIT
User Manual

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1 Introduction

CMA3000 demo demonstrates the CMA3000 component functionality and the component key properties. This document describes how to install the required software and how to use the CMA3000 demo board and Graphical User Interface (GUI) software.

CMA3000 demo consists of:

- CMA3000 sensor soldered on chip carrier PWB (see Figure 1 on next page)
- USB interface card (see Figure 1 on next page)
- USB cable
- GUI software running on PC

The CMA3000 DEMO KIT supports digital CMA3000 series sensor, CMA3000-D01. The support for analog CMA3000-A01 will be added later. The evaluation boards (SCA3000 PWBs) are compatible with the SCA3000 DEMO KIT.

CMA3000 demo runs on Windows XP and 2000, it requires USB connection for data transfer. Demo is powered from USB port. The current GUI software does not support Windows Vista. The CMA3000 demo is based on the same USB hardware PCB as the SCA3000 DEMO KIT, also the same driver can be used with all demo kits provided by VTI Technologies.

2 Quick start for using the CMA3000 DEMO KIT

Please follow the steps below:

1. Insert CD-ROM
2. Setup the hardware
   - Connect the demo kit to PC's USB port
3. Install the USB driver, after the PC has found the device
   - When the PC detects the new USB device, do not let Windows to detect the driver, address the USB driver from folder:
     `"CD-ROM\CMA3000 demo - Virtual Com Port Drivers\"`
   - NOTICE, if you have already installed some other demo kit provided by VTI Technologies, please check that the latency timer parameter is 5 ms. In case the latency timer value is greater than 5 ms, the CMA3000 DEMO KIT GUI will not work (more detailed instructions in section 9)
4. Install the GUI software
   - Install the GUI software by running the "`setup.exe`" from folder:
     `CD-ROM\CMA3000 demo – GUI Installer`
   - Do not change the installation destination
5. Start the GUI software
   - From Start → Programs → CMA3000-USB-DEMO-VER-1.1 → CMA3000-USB-DEMO-VER-1.1

When using the CMA3000 DEMO KIT with GUI software:

- The DEMO KIT should be connected to PC before the GUI software is started
- Exit the GUI software before unplugging the DEMO KIT from PC
- After GUI software is stopped, the DEMO KIT can be unplugged from PC (DEMO KIT uses virtual serial port driver, so it can not be found as a USB device).

During software start up, the firewall may alert that the demo software wants a network access. The demo software can be operated without the network access (granting the network access won't change the software operation.)

3 Hardware

The CMA3000 DEMO KIT USB interface board (black PWB) and CMA3000 PWB (green PWB) are shown in Figure 1. The USB interface card converts the USB interface to SPI or I^2C interface. CMA3000 sensor is soldered on PWB which is connected to interface board.

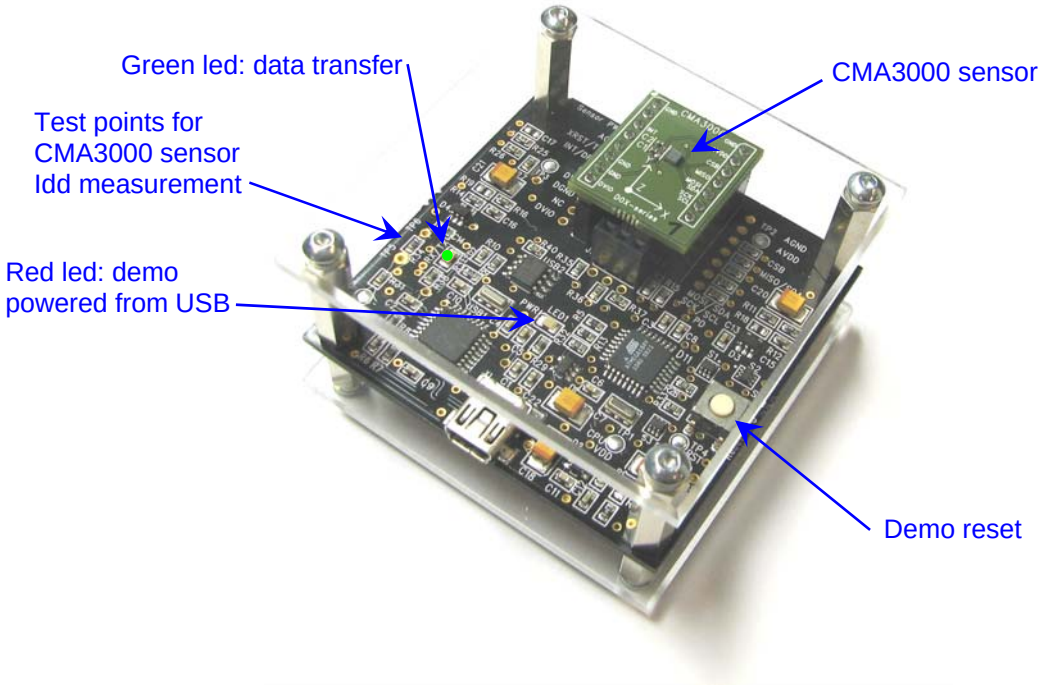


Figure 1. CMA3000 demo USB interface board and CMA3000 PWB.

4 GUI software

CMA3000 DEMO KIT is controlled via USB serial port by GUI software.

The GUI software has four different display modes. The CMA3000 sensor can be set to:

- normal measurement mode,
- normal measurement mode with free fall detection enabled and
- motion detection mode.

The interrupt detected due free fall or motion is indicated by led indicator and sound (if PC sounds are enabled). Once interrupt is detected, the interrupt has to be cleared by user by pressing the red led. The led appears on display only when the interrupt is detected.

The four different GUI displays and start up screens are presented below.

Screen capture of the GUI is presented in Figure 2.

Figure 2. SCA3000 DEMO KIT Graphical User Interface

Table 1. The numbered items in Figure 2.

Item	Description
1	Exit software, [Esc]-button also.
2	INT-pin interrupt is displayed as an indicator in this area (**Free Fall** has to be selected from pull down menu #13)
3	Resultant acceleration ON / OFF ($Res = \sqrt{x^2 + y^2 + z^2}$).
4	Save acceleration data in to text file.
5	Freeze image, start / stop the scrolling window, [Page-Up] button also.
6	Open / close the window extension with arrow button (available only in SCROLL display).
7	Pull down menu for acceleration [g] range (Y-axis).
8	Manual Y-axis range selections (Manual setting has to be selected from Range pulldown menu)
9	Current acceleration output value decimal display
10	Selected sensor type and GUI software version number.
11	Averaging ON / OFF, number of samples for averaging.
12	Measuring range (G_RANGE bit setting).
13	Pull down menu for CMA3000 operation mode & operation mode configuration.
14	Pull down menu for GUI display mode.

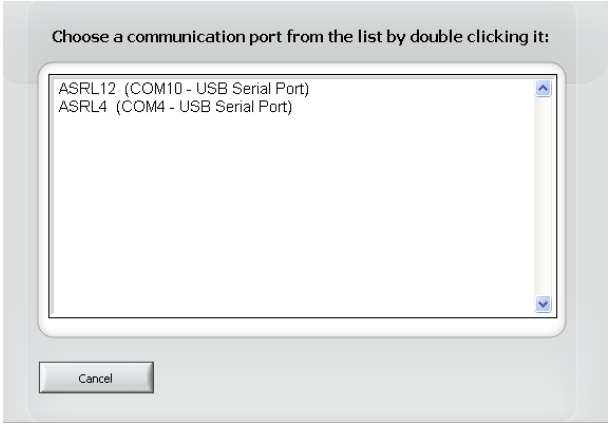

Choose a communication port from the list by double clicking it:
ASRL12 (COM10 - USB Serial Port)
ASRL4 (COM4 - USB Serial Port)
Cancel

Figure 3. USB serial port selection pop-up window.

If more than one USB serial port devices are connected to PC, user must select the correct **USB SERIAL PORT** from pop-up window (Figure 3). If user does not know the correct USB serial port number, please disconnect all other USB serial port devices from PC and restart the GUI software.

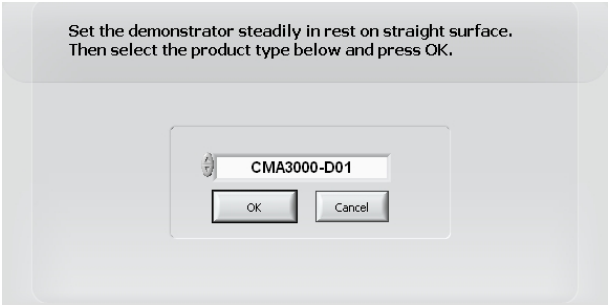

Set the demonstrator steadily in rest on straight surface.
Then select the product type below and press OK.
CMA3000-D01
OK
Cancel

Figure 4. Product selection pop-up window.

User needs to select the correct product type from **PRODUCT SELECTION** pop-up window (Figure 4). CMA3000-D01 is selected by default.

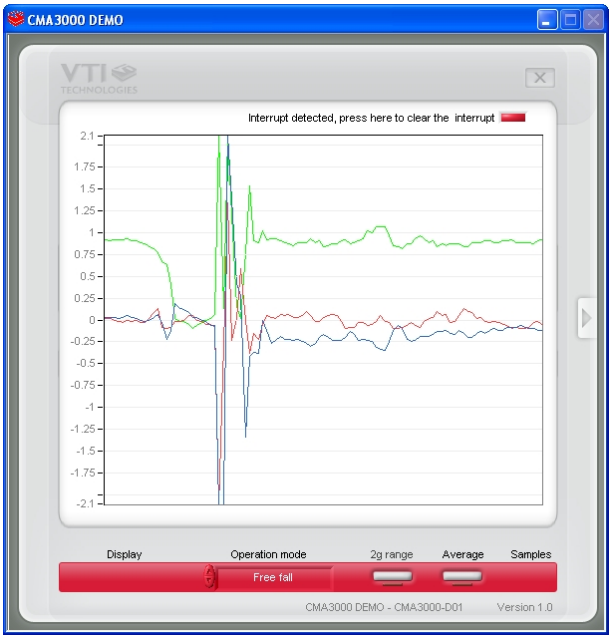


Figure 5. Scroll display.

SCROLL, continuously scrolling X, Y, Z and resultant accelerations, see Figure 5. Acceleration is presented in [g]. User can:

- change the acceleration scale
- freeze the scrolling image
- change the averaging factor
- set averaging OFF
- save acceleration data into file
- enable/disable resultant scrolling
- select between sensor measurement ranges 2g/8g
- demonstrate/test CMA3000 motion detection and free fall modes

Most of the actions/controls listed above are in the extension part of the window, which can be accessed by pressing the arrow button (see Figure 2 and Table 1).

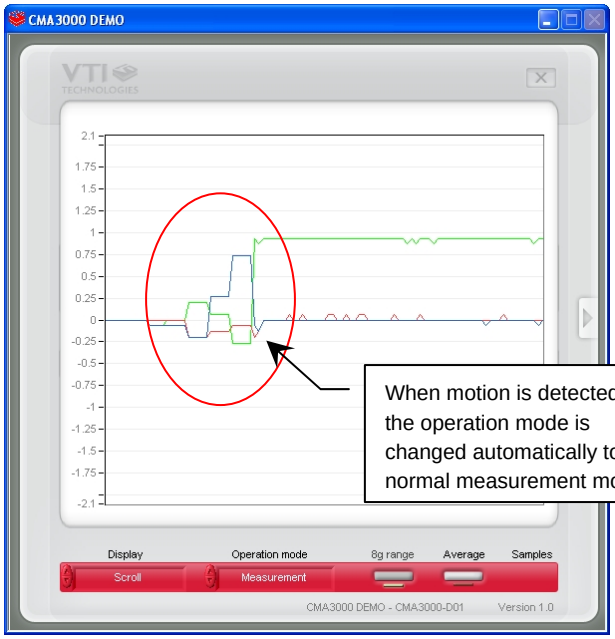


Figure 6. Scroll display with detected motion.

MOTION DETECTION, CMA3000 is set to motion detection with configuration where operation mode is changed to normal measurement mode when motion is detected.

CMA3000 acceleration output is band pass filtered in motion detection mode. The transition from motion detection mode to normal measurement is presented in Figure 6.

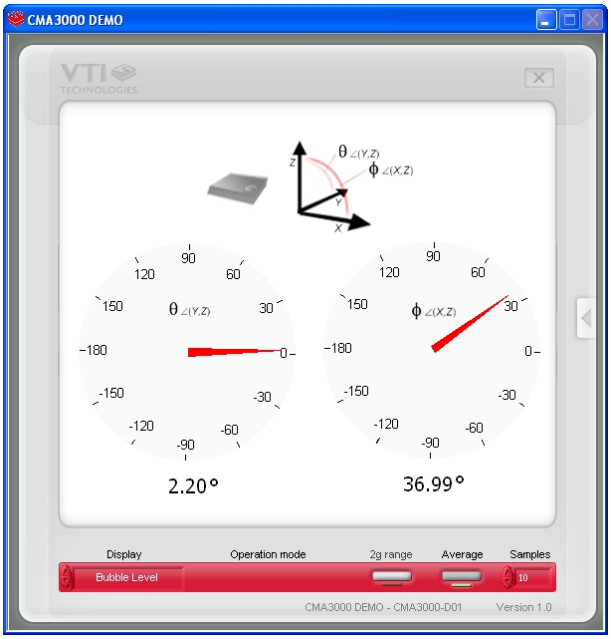


Figure 7. Bubble level display.

BUBBLE LEVEL, two displays that show tilt angle, see Figure 7. Angle calculation is performed in GUI, not in CMA3000 sensor.

CMA3000 sensor averaging can be enabled / disabled.

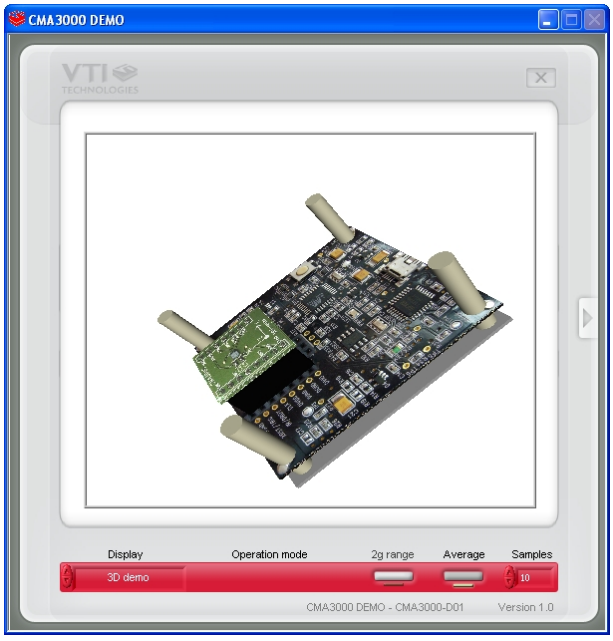


Figure 8. 3D demo display.

3D demo, a 3 dimensional demo kit virtual model follows the tilt angles of the real CMA3000 demo kit, see Figure 8. Averaging can be adjusted to smoothen the demo model movements.

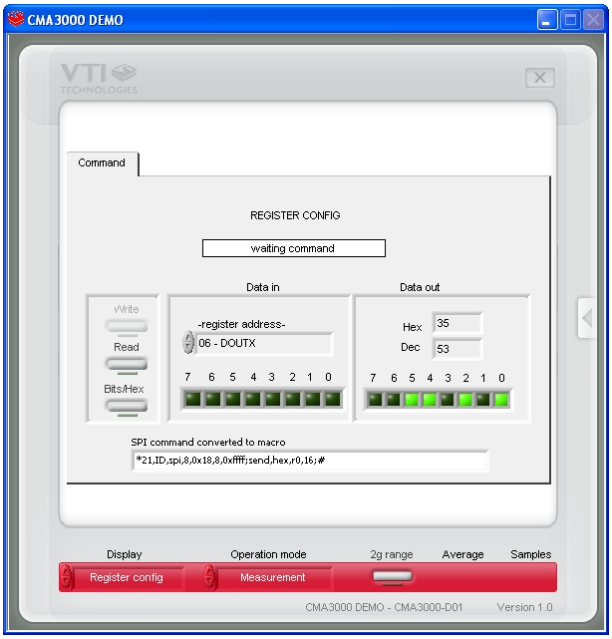


Figure 9. SCA3000 register configuration display.

REGISTER CONFIG display offers user access in to CMA3000 sensor internal registers. Registers can be read and written. The written data format can be changed between binary and hexadecimal by pressing the "Bits / Hex" button.

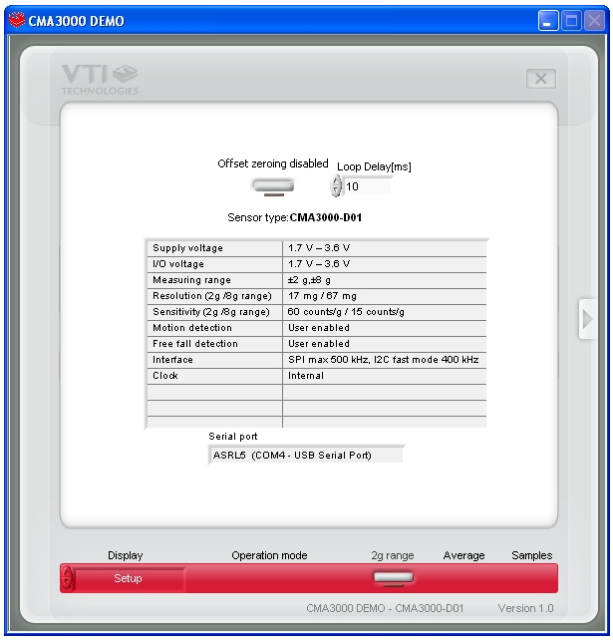


Figure 10. Setup display.

SETUP display presents some operational parameters of selected sensor type, please refer to component specific documentation for further information.

The used virtual serial COM port number can be viewed from "Serial port" display. This information is needed if the CMA3000 DEMO KIT is used without the GUI software, see further details from **section 5**.

In this example the CMA3000 DEMO KIT uses COM39 serial port.

Figure 11. Reset demo display.

RESET DEMO initialises the GUI software. The embedded MCU software version is presented also. SCROLL display opens after RESET by default.

4.1 Resetting GUI and µC

CMA3000 DEMO KIT GUI software can be reinitialised by selecting the “Reset demo” display from pull down menu, see Figure 11.

MCU can be reset by exiting from the GUI and then pressing the reset button (Figure 1) on USB interface board.

4.2 Uninstalling the GUI and USB driver

The GUI software and the USB driver (FTDI Serial Converter Driver) can be removed from Windows Control Panel Add/Remove Programs. Please notice that removing the FTDI Serial Converter Driver (USB driver) may affect on functionality of some other programs (such as other demo kits provided by VTI Technologies).

5 Advanced data logging

Acceleration data can be saved from GUI software by pressing the “Save to file” button (Figure 2). Data can be logged also by using the Windows HyperTerminal software and macro language that is used to control the MCU of the CMA3000 DEMO KIT.

Please notice that GUI software and Windows HyperTerminal software can not be open at the same time. Follow the steps below to start the data logging:

1. Connect CMA3000 DEMO KIT with USB cable to PC
2. Open GUI software to see the correct COM port number (SETUP display, see Figure 10). Windows Device Manager can be also used to find out the COM port number.
3. Close the GUI software.
4. Open Windows HyperTerminal software from CD-ROM:
   - “CMA3000_demo_HyperTerminal_connection.ht”, or
   - see detailed serial communication settings in Table 2.
5. Press demo reset button (see Figure 1). CMA3000 DEMO KIT sends an info text to HyperTerminal (see Figure 12). If the HyperTerminal software is unable to connect the CMA3000 DEMO KIT or the info text does not appear,
   - Press disconnect ,
   - change the COM port number to correct from port properties
   - press connect ,
   - press reset button on CMA3000 DEMO KIT.

   until info text appears to HyperTerminal screen (see Figure 12).
6. After the info text appears on HyperTerminal, send the wanted macro text file, such as “CMA3000_data_logger.txt” from CD-ROM (“Transfer” pull down menu → “Send Text File…” → browse for CMA3000_data_logger_macro.txt)
7. The text file is a macro that runs in an endless loop. The macro sends 3-axis acceleration data in hex format to HyperTerminal (see Figure 13). Example of data format:
   `0x3c,0x01,0x01,Z-Y-X`
   where “0x” indicates for hex format, and “`Z-Y-X`” the axis order. The Z-axis hex output is 3C, which is ‘0011 1100’ in binary format.
8. The data can be stored by capturing the data in to file:
   “Transfer” pull down menu → “Capture Text…” → save captured data into wanted file and folder.
9. Data capturing can be stopped from:
   “Transfer” pull down menu → “Capture Text…” → “Stop”

Macro language is used to control the CMA3000 DEMO KIT. It can be also used to configure the CMA3000 sensor. For more detailed information of macro language, please refer to “SCA3000 DEMO KIT macro language description 8259200”.

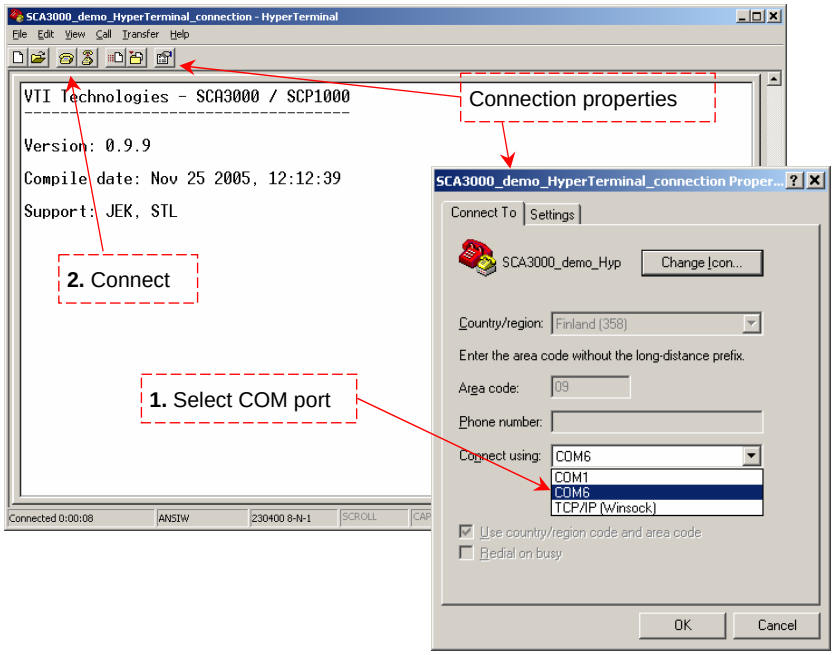


Figure 12. Windows HyperTerminal with CMA3000 demo info text.

If the pre-configured HyperTerminal connection is not available (the CD-ROM), the HyperTerminal connection can be opened also from:

→ Start → Programs → Accessories → Communications → HyperTerminal

The communication settings are presented in Table 2 below

Table 2. CMA3000 DEMO KIT serial communication settings.

Parameter	Value
Bits per second	230400
Data bits	8
Parity	None
Stop bits	1
Flow control	None

The correct COM port number depends on the PC and used USB port.

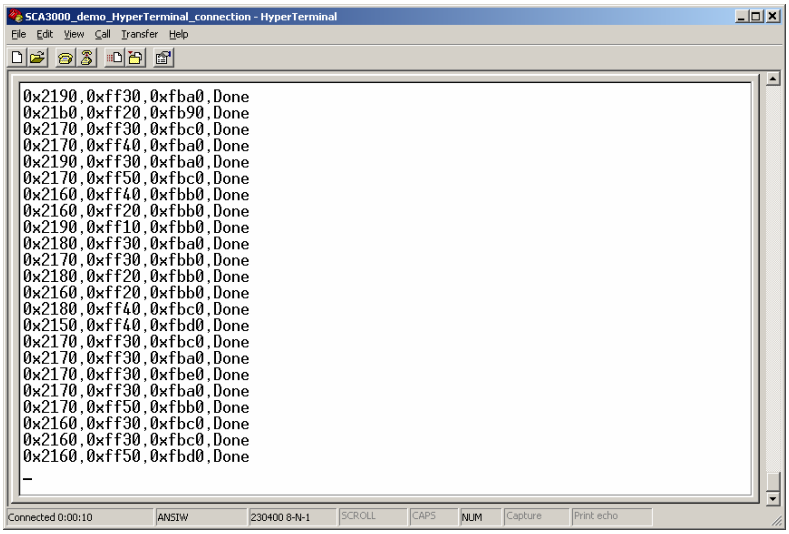


Figure 13. SCA3000 demo output during data logging.

6 CMA3000 current consumption measurement with DEMO KIT

The current consumption of the CMA3000 sensor can be calculated by measuring the voltage drop over the resistor R34 (470 Ω, 1% tolerance). Voltage drop can be measured from test points TP5 and TP6, see DEMO KIT USB interface board circuit diagram in Figure 16 (PCB design VTI 29393 rev B0).

The offset current consumption of the DEMO KIT hardware depends on used serial communication (SPI vs. I^2C). The offset current consumption according to serial communication type is presented in Table 3 below.

Table 3. Offset current consumption of the CMA3000 DEMO KIT HW.

Serial interface	Offset current consumption
SPI	~950 µA (V_{offset} = 444 mV)
I^2C	~200 µA (V_{offset} = 94 mV)

The offset current consumption can also be measured by measuring the voltage drop over the resistor R34 (TP5 and TP6, see Figure 16) when CMA3000 PWB is not connected to USB interface board.

SCA3000 current consumption can be calculated

$$Idd = \left(\frac{V_{drop} - V_{offset}}{470\,\Omega} \right), \quad (1)$$

where V_{drop} is the measured voltage drop in [V] (from TP5 to TP6, see Figure 16), V_{offset} is the measured offset current consumption (from TP5 to TP6, see Figure 16), alternatively the values from Table 3 can be used. Idd is the CMA3000 current consumption in [A].

The difference in offset current consumption is due the pull up resistor in SCK/SCL line (R2 in Figure 15). When using SPI-bus, the MCU software drives the SCK/SCL line low when there is no communication, which results in increase in DEMO KIT offset current consumption (current through resistor R2 in Figure 15 from DVDD to GND). When I^2C is used, the MCU releases the SCK/SCL line when there is no communication.

7 USB interface board circuit diagram

CMA3000 demo USB interface board circuit diagram is presented in following pages.

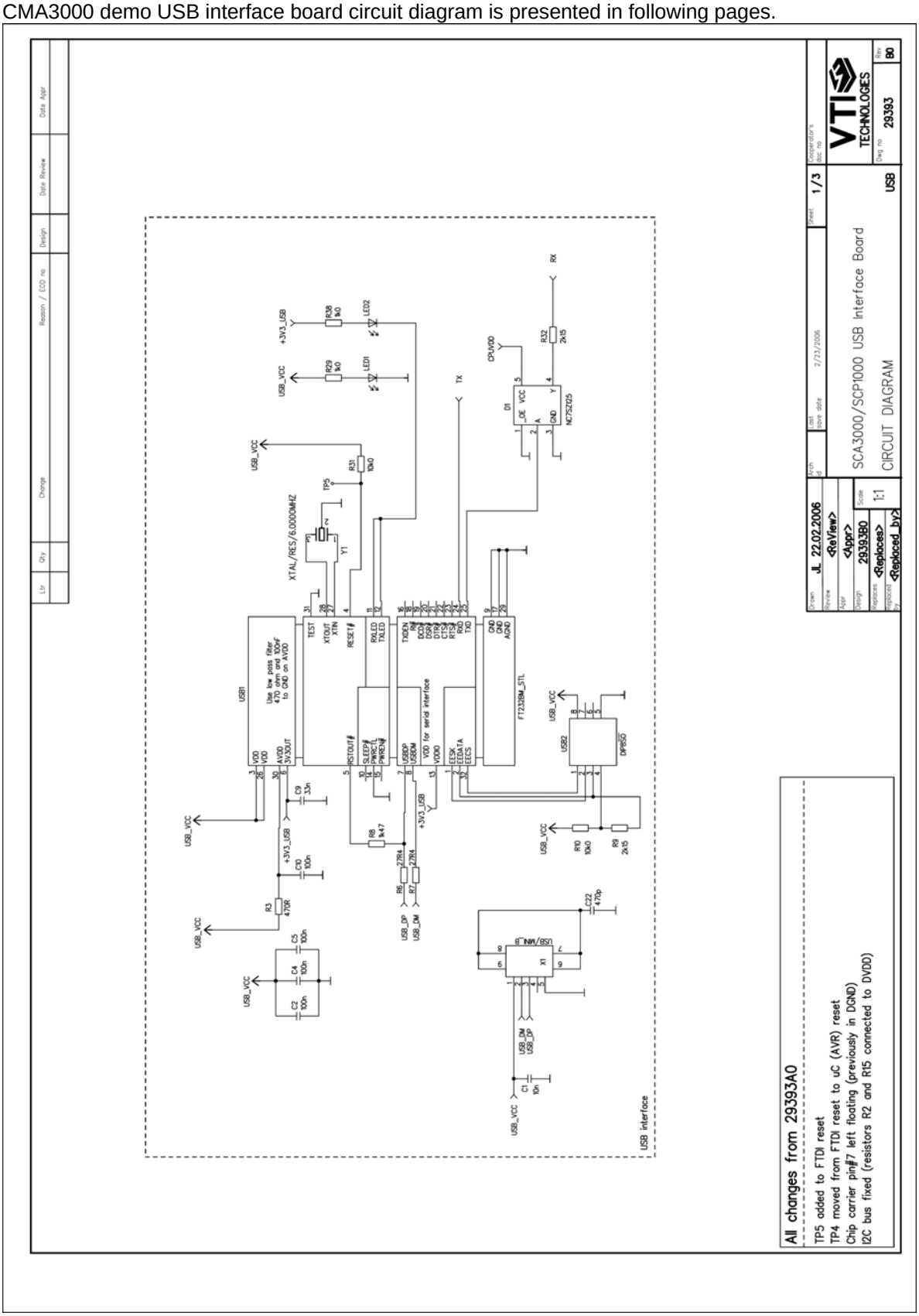


Figure 14. CMA3000 DEMO KIT USB interface board circuit diagram (sheet USB).

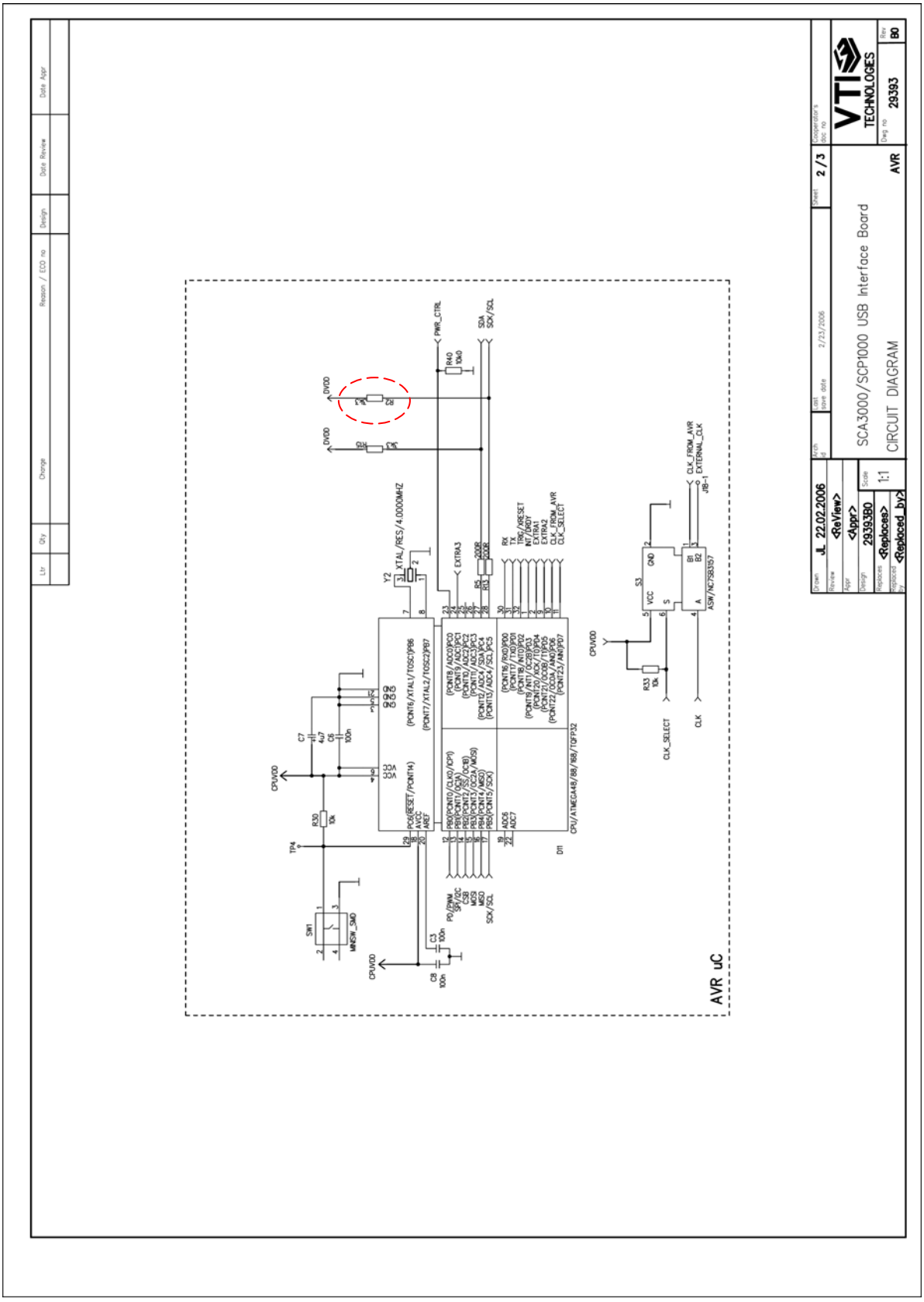


Figure 15. CMA3000 DEMO KIT USB interface board circuit diagram (sheet MCU).

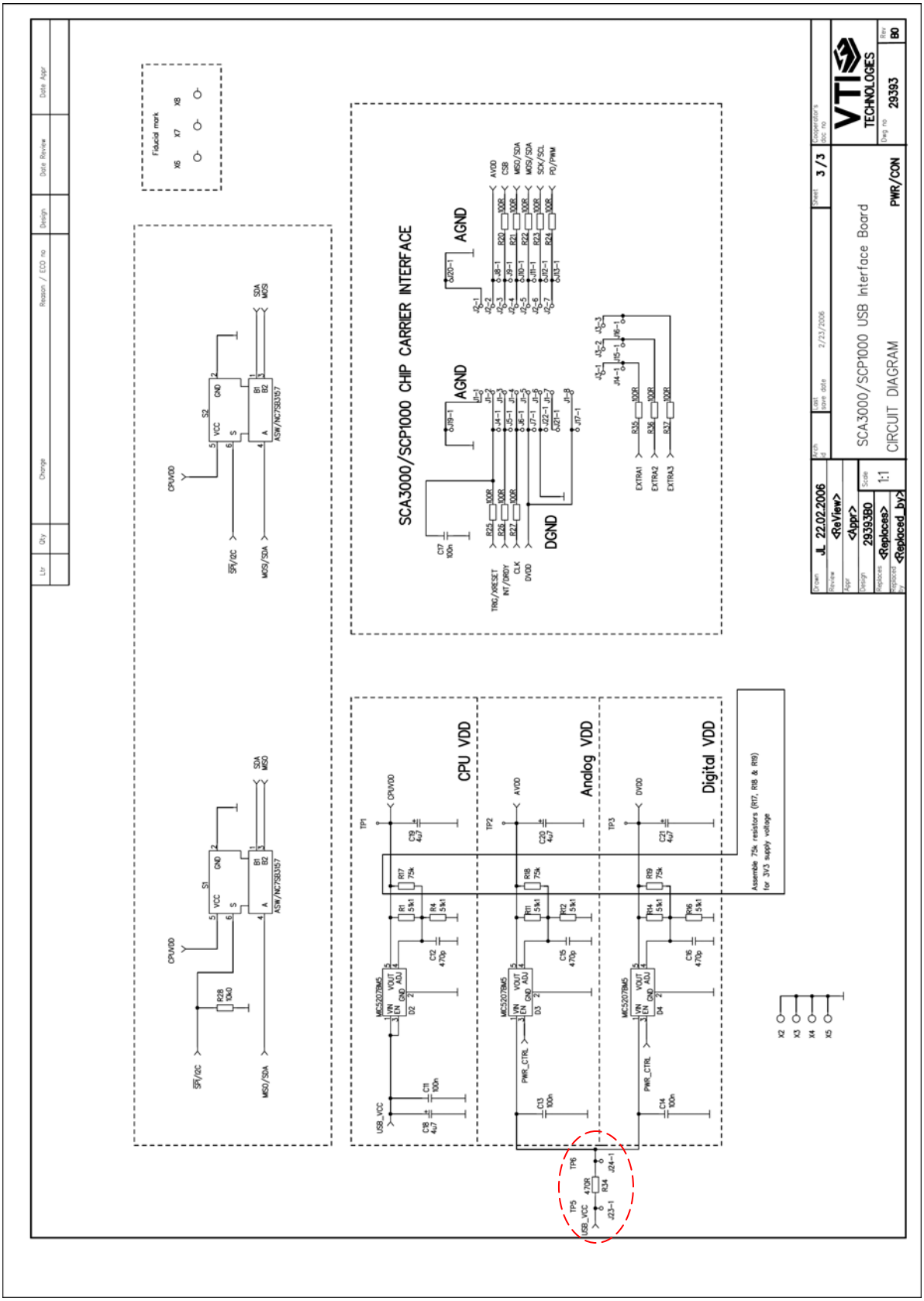


Figure 16. CMA3000 DEMO KIT USB interface board circuit diagram (sheet power).

8 USB interface board PWB layout

CMA3000 DEMO KIT USB interface board PWB layout and silkscreen is presented below.

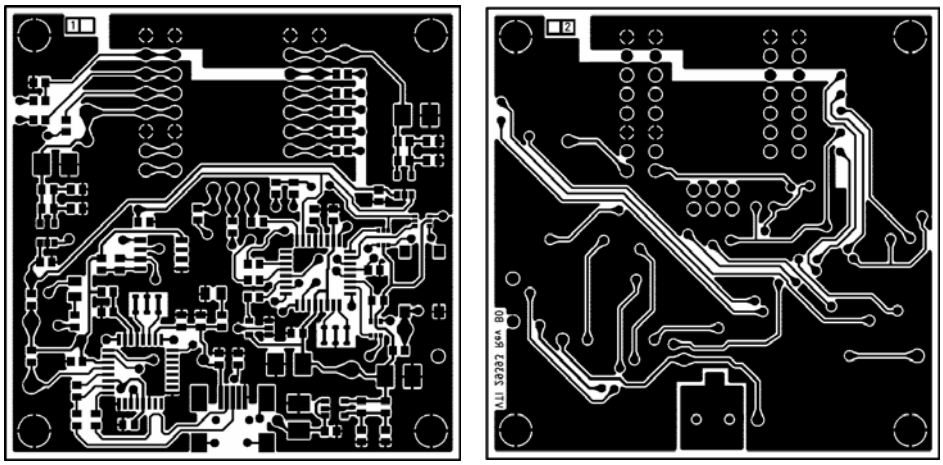


Figure 17. CMA3000 DEMO KIT USB interface board PWB layout.

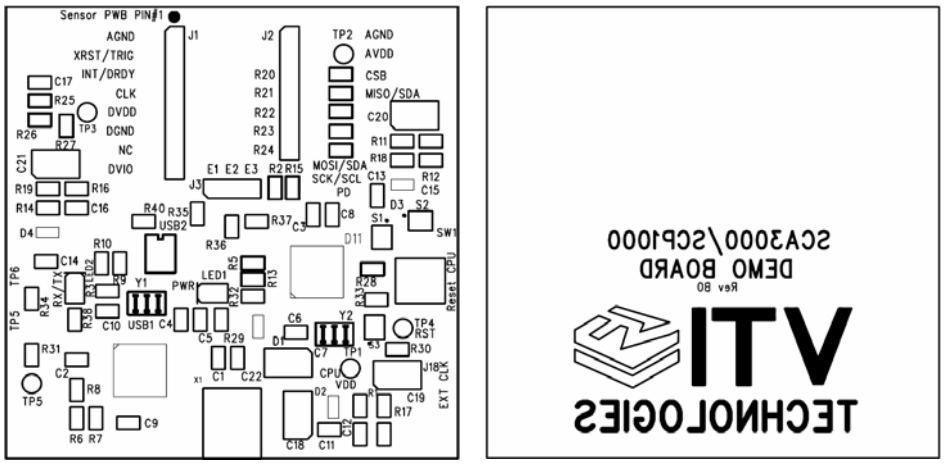


Figure 18. CMA3000 DEMO KIT USB interface board silkscreen.

9 Troubleshooting

Due to many PC environments, the interoperability can be limited. The CMA3000 DEMO KIT has been tested with DELL laptops (Latitude D600, D610, D410) and desktop PCs with Win2000 and WinXP operating system. If the CMA3000 DEMO KIT does not work properly or its operation is limited, the following items may help to sort the problems out:

1. Stop the GUI software, press the reset button program on demo USB interface board (see Figure 1), re-start the GUI again.
2. CMA3000 demo may not work properly if your PC has multiple USB serial port devices installed. Please remove all other USB serial port devices (including other VTI demos).
3. Close Windows HyperTerminal software, if you have used it.
4. If the GUI interface starts, but data is not scrolling in the window, check that USB driver LATENCY TIMER parameter is 5ms, please see details in section 9.1
5. Some times other LabView based software do not allow the demo kit GUI software execution, please try to install the CMA3000 demo kit to another PC or remove other LabView based software
6. If the PC is unable to find the demo kit serial port, try another USB port. Also, please check that there are not duplicate serial COM port numbers, more details in section 9.2.
7. The CMA3000 demo kit GUI does not support Windows Vista
8. Test the demo with another USB cable.
9. Please check that does the communication work between the demo kit and the PC:
    - Open HyperTerminal connection to the demo (see section 5)
    - Press demo reset button (see Figure 1)
    - see if the info text appears on the screen (see Figure 12)

   → if the info text is transmitted, the communication between the demo kit and PC is ok

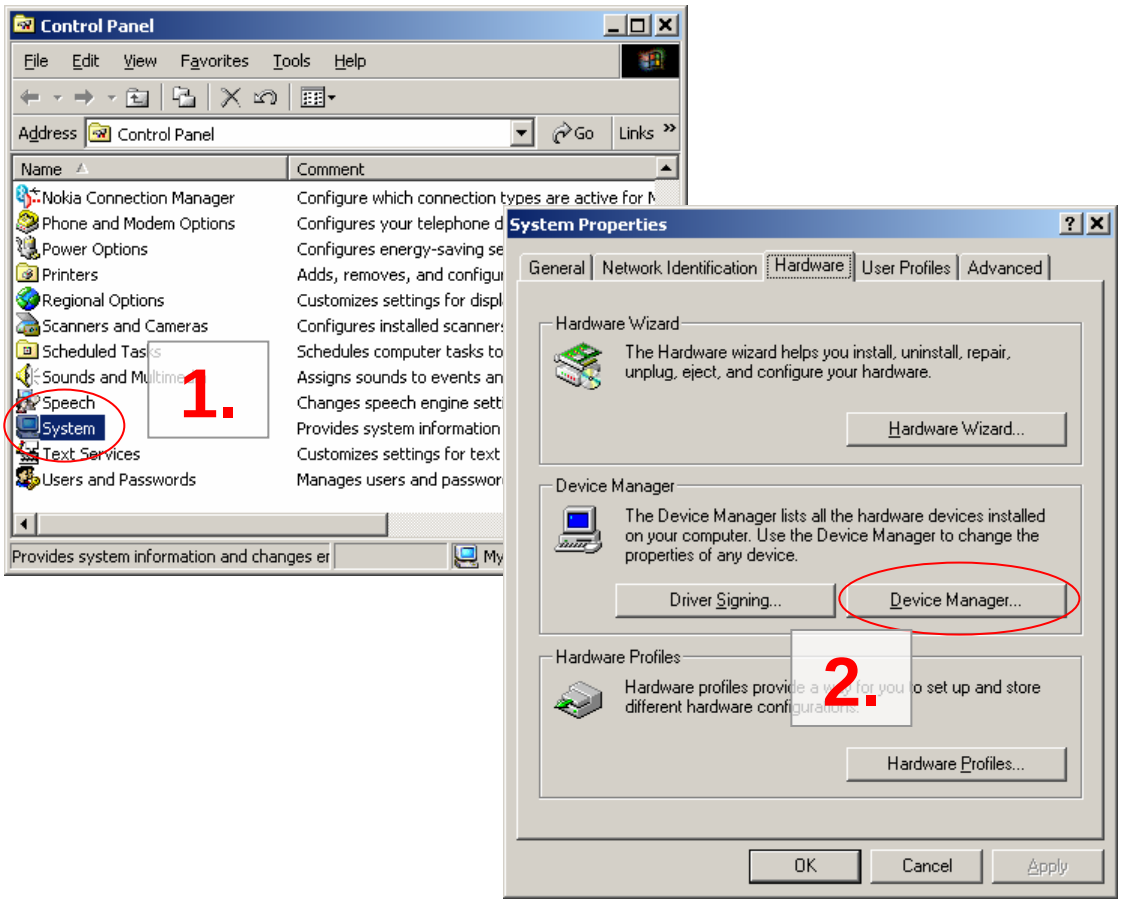
9.1 Checking and setting correct USB driver Latency timer value

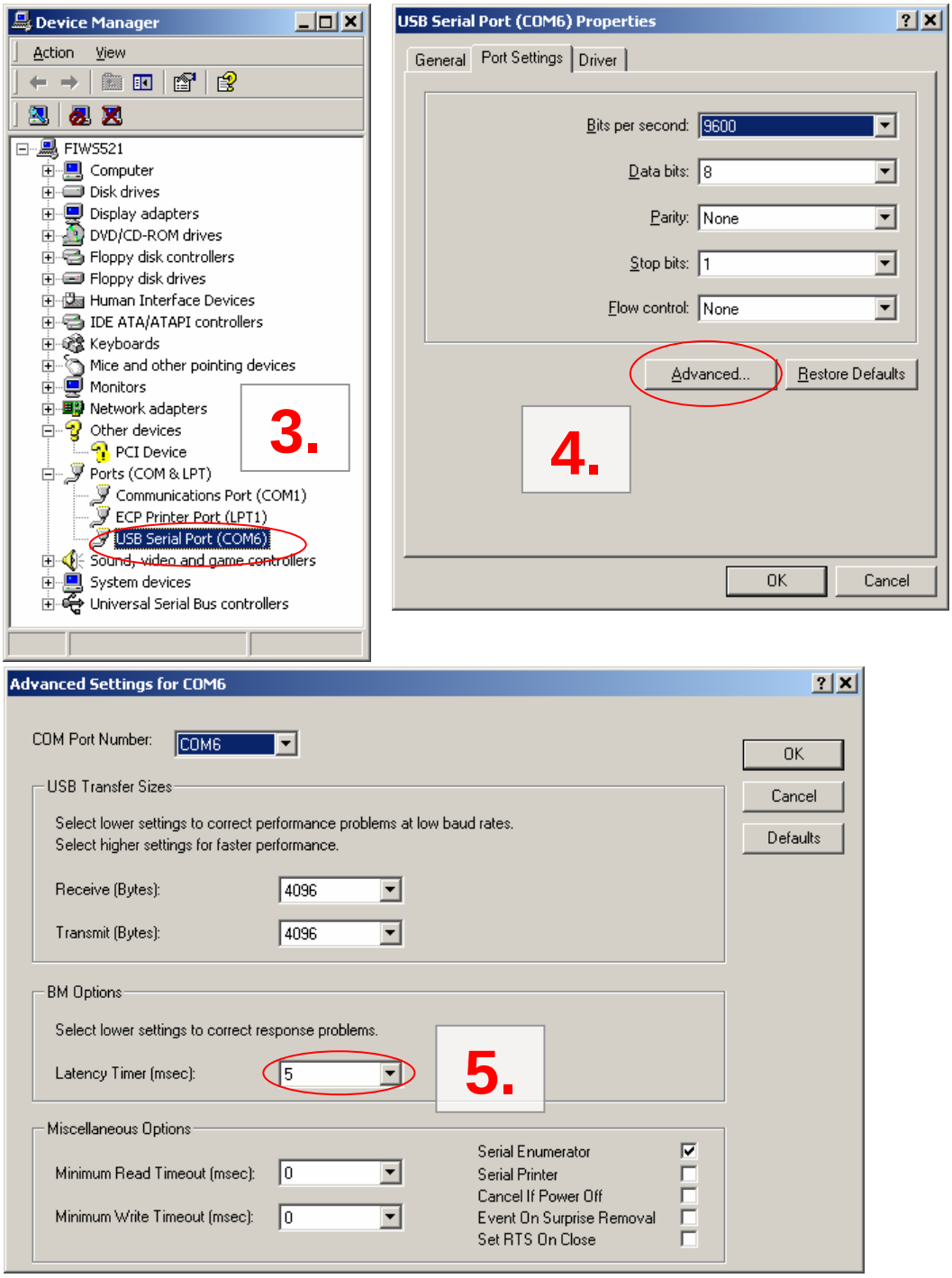
The FTDI USB Virtual Serial Com Port driver is delivered with the CMA3000 demo kit and the same driver version can be also downloaded from VTI's website. This driver is a slightly modified version of the original FTDI's driver: the driver used with VTI's demos must have a modified Latency timer setting. If the original FTDI's driver version is used, the demo may not work properly.

In order to modify the driver's Latency timer value, please plug the demo USB cable in to PC and follow the steps (and screen captures) below:

1. Open control panel and select “SYSTEM”
2. Select “DEVICE MANAGER” from “HARDWARE” tab
3. Select “USB SERIAL PORT” from the list, right mouse click and select “PROPERTIES"
4. Select “ADVANVED” from the USB Serial port Properties
5. Set the “LATENCY TIMER” to 5 ms (the 16ms default value is too slow for SCA3000 DEMO KIT).
6. Press “OK” to all windows.
7. Restart the GUI software.

Start → Settings → Control panel




Device Manager
Action View
FIWS521
Computer
Disk drives
Display adapters
DVD/CD-ROM drives
Floppy disk controllers
Floppy disk drives
Human Interface Devices
IDE ATA/ATAPI controllers
Keyboards
Mice and other pointing devices
Monitors
Network adapters
Other devices
PCI Device
Ports (COM & LPT)
Communications Port (COM1)
ECP Printer Port (LPT1)
USB Serial Port (COM6)
Sound, video and game controllers
System devices
Universal Serial Bus controllers
3.
USB Serial Port (COM6) Properties
General
Port Settings
Driver
Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None
Advanced...
Restore Defaults
4.
OK
Cancel
Advanced Settings for COM6
COM Port Number: COM6
OK
Cancel
Defaults
USB Transfer Sizes
Select lower settings to correct performance problems at low baud rates.
Select higher settings for faster performance.
Receive (Bytes): 4096
Transmit (Bytes): 4096
BM Options
Select lower settings to correct response problems.
Latency Timer (msec): 5
5.
Miscellaneous Options
Minimum Read Timeout (msec): 0
Minimum Write Timeout (msec): 0
Serial Enumerator
Serial Printer
Cancel If Power Off
Event On Surprise Removal
Set RTS On Close

9.2 Duplicate serial COM port numbers

Some PCs assign duplicate COM port numbers for virtual com port devices. If the PC assigns a com port number for demo kit that is already reserved by another device, the demo kit will not work properly (see **Figure 19**).

COM port numbers can be seen from Computer Management (Device Manager), see section 9.1 for instructions on opening the Device Manager.

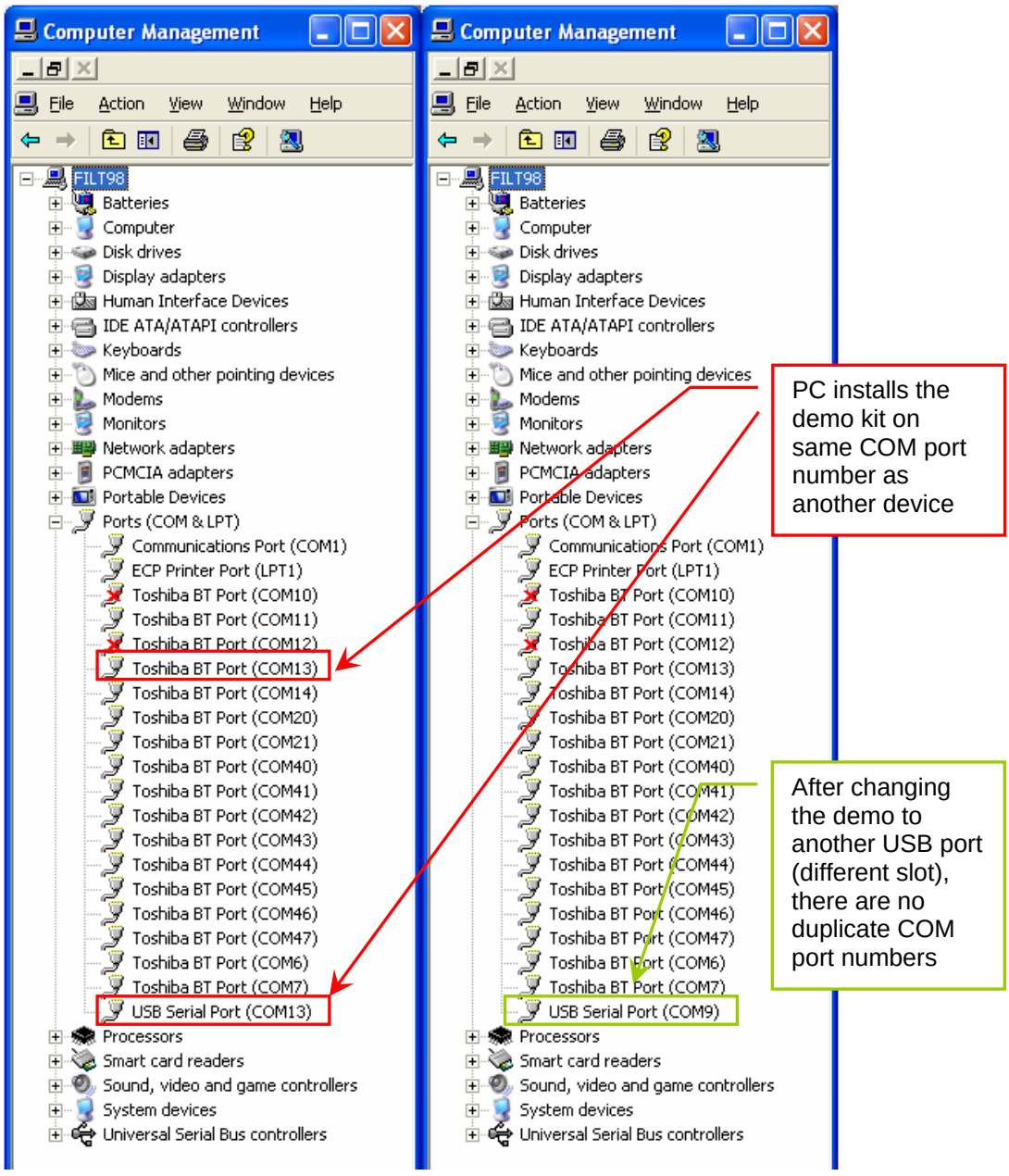


Figure 19. PC has assigned duplicate COM port numbers for two devices (LEFT), after changing the USB port there are no duplicate COM port numbers (RIGHT).

9.3 Known Issues

9.3.1 Changing the serial bus type

The MCU needs to be reset (by pressing the reset button, see Figure 1) when changing between the two available serial bus types (SPI & I^2C). This thing can happen when user communicates with CMA3000 with macros that utilize different serial bus types.

10 Document Revision History

Version	Date	Change Description
0.1	19.02.2008	1st version
0.2	19.02.2009	Corrected document number in header, front page picture updated

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